Life Sciences 2L03
Living Systems Lab

LEAD INSTRUCTOR:
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MODULE INSTRUCTORS:
Ryan Belowitz
Rosa da Silva
Nikol Piskuric
Janet Pritchard
Sunita Nadella

GUEST LECTURERS AND MODULE DEVELOPERS:
Russ Ellis
Maikel Rheinstadter
Xu-Dong Zhu

LAB MANUAL DEVELOPER:
Shira Weiss

LABORATORY TECHNICIAN:
Geneviève van Wersch (ABB119)

INSTRUCTIONAL ASSISTANT:
Ryan Belowitz (ABB119)

COURSE DESCRIPTION:

In this laboratory-based, inquiry course we will explore diverse techniques used by researchers to probe fundamental questions in the Life Sciences. The questions that we will examine in Winter 2017 will address fundamental processes of human ageing.

During the first five modules, we will examine the impacts of ageing on tissues including skin and neural systems, we will consider how neurodegenerative disorders of ageing are associated with protein aggregation, and we will identify genes that impact the cellular ageing process. The first half of the course we will also participate in ageing simulations that will help us to understand how our bodies change with age. In the next five modules, we will look explore the impact of ageing on bone, neuromuscular junctions, and mobility. We will probe aspects of cellular ageing including cellular senescence and telomere shortening. We will explore how epidemiological studies can inform our understanding of human ageing. Throughout the course, will see how basic research on model organisms can be used to understand and enhance human health and well-being and how such translational research has already impacted our society. We will also explore how ageing is perceived and defined in our society through simulations of the physiological effects of ageing and the examination of how ageing research is represented in popular media.

COURSE AIMS:

In this course, students will have the opportunity to:

- Develop a scientific attitude towards data analysis and interpretation.
- Use various techniques and equipment common to studies in physiology, histology, and molecular biology.
- Use different forms of microscopy in the capture and analysis of data.
- Use animal model systems to study mechanisms of physiological and cellular ageing.
- Learn how to present data for different audiences.
Engage in scientific discourse with peers and instructors.
Reflect upon skills learned in the lab.
Gain an understanding of the principles of translational research
Discuss the relevance of basic research in society

ONLINE CONTENT:
This course uses Avenue to Learn to post the course outline, assignments, and other notices.
Go to http://avenue.mcmaster.ca to find out how to log-on to the course’s platform.

TEXTBOOK:
There is no required textbook for this course. Required readings will be provided for each lecture.

EVALUATION:
Each lecture will be preceded by an online quiz that will prepare you for the lecture content and the lab techniques.
Working in groups of four, you will maintain a collaborative online lab notebook in which you will collect, analyze, and summarize data and plan future experiments.
There will be two practical lab tests that you will complete individually and will allow you to demonstrate your laboratory and analytical skills.
There will be two opportunities to practice scientific communications, through one presentation and one essay.
There will be opportunities for reflections on tutorial activities.

Online quizzes: 10% (individual; pre-lecture and pre-lab material)
Lab notebook: 10% (assessed on a weekly basis, group contributions)
Lab/Tutorial assignments: 25% (group)
Practical tests: 30% (individual; 2 x 20% each)
Presentation: 10% (group; due and presented the week of April 3rd in lab)
Essay: 10% (individual; due Friday February 10th)
Reflections and ePortfolio: 5%
Attendance at MIREx: bonus on first practical test

SCHEDULE:
Every module will begin with a lecture on Monday (50 minutes) that will introduce the topic.
Your lab will fall on a Monday, Tuesday, Wednesday, or Thursday (1 hour and 50 minutes)
Your tutorial will come Wednesday, Thursday, or Friday (1 hour and 50 minutes)

NOTE: Your lab and tutorial scheduling are tied so that you are in the same lab and tutorial as your group partners each week. When you select your lab time, your tutorial time is automatically assigned.

MODULES:

PART A:
Week 1: introduction to the lab in tutorial time
January 4th to 6th  PLEASE COME TO ABB106 for your Tutorial this week only
Citizen science and AgeGuess
Introduction to the microscope
Week 2: Accelerating ageing  
January 9th to 13th  
Topic lead: Sunita Nadella, Ryan Belowitz  
Some of the first outward signs of ageing in Western society are changes to our skin. What are the visible signs of skin ageing? What is happening to the skin tissues? We will use histological techniques for preparing skin tissue and to study the microanatomy of the skin under the microscope. Diverse environmental parameters can accelerate aging including temperature, exposure to UV light, oxygen supply, and desiccation. How might these factors alter skin ageing?

Week 3: Neurobiology  
January 16th to 20th  
Topic lead: Nikol Piskuric  
The SpikerBox is a "bioamplifier" that allows you to hear and see action potentials of real living neurons. We will use insects as a model for studying neural function using the SpikerBox and examine studies conducted in humans to measure changes that occur with ageing.

Week 4: Models for neurological diseases  
January 23rd to 27th  
Topic lead: Kim Dej and Maikel Rheinstadter  
Neurodegenerative disorders are a prevalent sign of ageing. Alzheimer’s disease is the most common neurodegenerative disorder affecting over 36 million people worldwide. Cell membranes contain regions called lipid rafts that are rich in cholesterol. These regions provide an environment that promotes cleavage of the protein, APP. Fragments are released and can aggregate into clumps that damage the cell membrane and disturb the communication between cells in the brain, leading to the loss of memory and cognitive function. How can we study the formation and prevention of plaque formation in model systems?

Week 5: Genomics of ageing  
January 30th to February 3rd  
Topic lead: Kim Dej  
What genes have been identified in model organisms such as mice, flies, and worms as regulators of aging? What is the role of these genes in accelerated aging or perhaps decelerating or stopping aging? How can we identify the homologous genes in humans?

Week 6: Ageing simulation  
February 6th to 10th  
Topic lead: Janet Pritchard  
What is it like to experience some of the physiological effects of ageing? An ageing simulation will occur in the lab followed by a writing tutorial.  

Week 7:  
February 13th to 17th  
Lab practical test on Part A modules will occur in your lab time slot. This is an individual test.

READING WEEK  
February 20th to 24th

PART B:  
Week 8: Ageing and bone health  
February 27th to March 3rd  
Topic lead: Janet Pritchard  
Looking at human bone samples from ages 18 to 95, we will identify changes that occur during ageing, see how bones samples can be used in forensics to identify age, and characterize features of healthy bones.
Week 9: Neuromuscular junctions
March 6th to 10th
Topic lead: Rosa da Silva and Ryan Belowitz
Using C. elegans as a model system, we will look at how the changes in neural function that occur with aging can alter the capacity for normal movement. We also explore how studies in a model system can inform our understanding of human ageing.

Week 10: Epidemiology
March 13th to 17th
Topic lead: Kim Dej in collaboration with Parminder Raina
The Canadian Longitudinal Study of Aging (CLSA; www.clsa-elcv.ca) is a large, national, long-term study of more than 50,000 people between the ages of 45 and 85. We will partner with CLSA to examine how longitudinal data can be used to understand healthy aging.

Week 11: Cellular senescence and telomere shortening
March 20th to 24th
Topic lead: Xu-Dong Zhu and Kim Dej
The Hayflick limit is a theoretical limit to the number of times that cells can divide. It is considered to be one explanation for the cellular basis of ageing. We will work with the researchers in the lab of Dr. Xu-Dong Zhu to assay senescence in ageing cultured cells. We will also consider the correlation observed in humans between telomere length and ageing and consider possible mechanisms to explain the association.

Week 12:
March 27th to 31st
Lab practical test on Part B modules will occur in your lab time slot. This is an individual test.

Week 13:
April 3rd to 7th
The anti-ageing market
How are companies profiting from our desire to stop ageing? (Presentations in groups during lab)

REQUESTS FOR RELIEF FOR MISSED ACADEMIC TERM WORK:

If you are absent from the university for a minor medical reason, lasting fewer than 3 days, you may report your absence, once per term, without documentation, using the McMaster Student Absence Form. Absences for a longer duration or for other reasons must be reported to your Faculty/Program office, with documentation, and relief from term work may not necessarily be granted.

When using the MSAF, enter the Instructional Assistant name and email (TBA) should be entered as the contact for the course and you must contact the Instructional Assistant to learn what relief may be granted for the work you have missed, and relevant details such as revised deadlines, or time and location of a make-up exam. Please note that the online MSAF can only be used for term work worth less than 25% and it cannot be used for the final examination.

With an approved MSAF the following accommodations may be granted (accommodation is not guaranteed).

• If you miss a lab or tutorial, you are accountable to your group. You may be able to catch up on data and analysis. You may not be given an opportunity to make-up the lab experience, which is testable on the practical lab tests.
• Missing a lab or tutorial without an MSAF will accrue demerit points. These points will be removed from your final course grade, but you will still be permitted to participate in preparation of group assignments and receive a grade, as appropriate.
• If you miss one of the two practical tests, you will be expected to complete an equivalent test within 24 hours of your return to campus, which is the time that you submit your MSAF (i.e. when you are well).
• If you miss a deadline for essay submission or a presentation, you will be expected to submit or present the assignment within 24 hours of your return to campus, which is the time that you submit your MSAF (i.e. when you are well). Any late submission without an MSAF will be deducted 10% per day.

**STUDENT RESPONSIBILITIES:**
To get the most out of the course, you must be prepared to:
• attend all sessions, make up all missed work, and provide documentation for authorized absences;
• interact frequently with faculty, students, TAs, and other support staff;
• plan and manage your own time;
• complete preparatory tasks (such as reading, writing assignments, and initial research) in advance of sessions;
• develop and use reflective learning skills (for example identifying learning objectives, planning and carrying out research tasks, acting on academic feedback);
• work as an effective, efficient, and responsive team member on group assignments;
• follow all the guidelines as outlined in the Introduction section of the Laboratory Manual;
• check the course Avenue site, and your McMaster and Avenue e-mail daily for updates; and,
• follow all university policies and guidelines, and in all ways be a responsible university member.

**SENATE STUDENT POLICIES**
Students can view full policies here ([http://www.mcmaster.ca/policy/Students-AcademicStudies/](http://www.mcmaster.ca/policy/Students-AcademicStudies/)). Senate Policy Statements are also available from the Senate Secretariat Office, Room 104, and Gilmour Hall.

**ACADEMIC INTEGRITY**
Academic dishonesty consists of misrepresentation by deception or by other fraudulent means and can result in serious consequences, e.g., the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university. It is your responsibility to understand what constitutes academic dishonesty.

The following illustrate only four of many forms of academic dishonesty:
• plagiarism, e.g., the submission of work that is not one's own or for which other credit has been obtained;
• copying or using unauthorized aids in laboratory exercises
• improper collaboration in group work; and
• copying or using unauthorized aids in quizzes, tests and examinations

All students are reminded of the importance of academic integrity, and the serious consequences of academic dishonesty.

**STUDENT CODE OF CONDUCT**
You acknowledge that your behavior in all aspects of this course should meet the standards of the McMaster University Student Code of Conduct. You understand that any inappropriate behavior directed against any of your colleagues, teaching assistants, or the instructional team will not be tolerated. Disruptive behavior during any session (e.g., lecture, seminar, lab, tutorial) such as talking, sleeping or non-class computing while an individual presents information, or constantly being late, will also not be tolerated. Abuse, ridicule, slander, inappropriate language, and discrimination towards instructors teaching staff, teaching assistants and other students will not be tolerated in any capacity.

Shared spaces including e-spaces such as the Avenue to Learn course discussion board are to be considered inclusive and safe.
**Plagiarism Detection**
In this course, we will be using a web-based service (Turnitin.com) to reveal plagiarism. Students will be expected to submit their work electronically to Turnitin.com and in hard copy so that it can be checked for academic dishonesty. Students who do not wish to submit their work to Turnitin.com must still submit a copy to the instructor. No penalty will be assigned to a student who does not submit work to Turnitin.com. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, etc.). To see the Turnitin.com Policy, please go to www.mcmaster.ca/academicintegrity.

**Copyright Policy**
In this course you will have access to material that is subject to copyright laws. This includes (but is not limited to) textbooks and all resources developed by the instructors such as lab manuals, demonstration videos, quizzes, assignments, tests, class notes and class slides. Under no circumstance are you allowed to share or redistribute this material in any printed or electronic form without the explicit written consent of the copyright holder. This includes posting any course material on Internet bulletin boards, course repositories, social networks, etc.

**The Instructors and the University Reserve the Right to Alter This Outline if Necessary**
The instructors and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.

**Grades**
Grades obtained in Life Science 2L03 will be converted according to the scheme generally used at McMaster University which can be viewed here: http://registrar.mcmaster.ca/exams/grades/ When the final marks are obtained, ALL borderline cases will be reviewed and, where warranted, adjustments will be made in the final mark.